Kent Cal Lab

INSTRUCTION MANUAL

FOR

Twelve Channel Noise Generator

Model TM7816A

MARCONI INSTRUMENTS
DIVISION OF MARCONI ELECTRONICS INC.

INSTRUCTION MANUAL

FOR

Twelve Channel Noise Generator

Model TM7816A

This Manual applies to
Serial Numbers US905

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Section 1

General information

1. INTRODUCTION

1.1 SCOPE OF MANUAL

This manual contains instructions for the installation, operation and maintenance of Twelve-Channel Noise Generator, Model TM7816A, manufactured by Marconi Instruments, Division of Marconi Electronics, Inc., Northvale, New Jersey 07647.

1.2 PURPOSE AND USE OF INSTRUMENT

Model TM7816A supercedes the earlier unit, designated TM7816, and incorporates a number of advances in design and construction while maintaining the same electrical specifications: Extensive use of integrated circuit technology significantly improves ruggedness and reliability; inclusion of precision components guarantees a tighter control of basic parameters.

Wherever possible, interchangeability of subassemblies between old and new units has been assured. (Refer to Appendix B.) Facilities for the addition of a Remote Programming option have been provided. (Refer to Appendix A.)

The unit provides twelve electrically separate channels of white, band-limited gaussian noise, with a maximum power level of 0 dBm. Each channel has a separate attenuator providing 32 dB of attenuation in 2dB steps. All attenuator sections are ganged together and driven electromechanically by a master control switch on the front panel. The frequency distribution of the noise

Fig. 1.1 Twelve-Channel Noise Generator, Model TM7816A

in each channel is flat over the range, 300Hz to 3.4kHz, and falls at 10 dB per octave outside this range.

Model TM7816A is designed for individual channel noise loading of 12-channel telephony systems; where individual loading on larger systems is required, a number of TM7816As may be used, although connection complexity may limit the maximum number of channels to 60. Overall system intermodulation distortion is measured as spurious noise in one channel. Multiplex noise and crosstalk can be measured separately by placing the "send" and "receive" multiplex back to back and then considering the combination as a complete system. The noise spectrum effectively simulates speech; the stimulus most commonly applied to the system. The only other equipment required for this test will be an AC level meter (or AC voltmeter).

1.3 GENERAL DESCRIPTION

The Twelve-Channel Noise Generator, Model TM7816A, consists of twelve entirely separate, fully solid state noise generators, each with its own section of the main ganged attenuator. An additional module provides power supply regulation and metering facilities, the entire instrument being housed in a bench/rack case fitted with carrying handles. For rack mounting, the feet may be removed.

1.4 DATA SUMMARY

The specifications to which the instrument is built are given in Table 1.1.

The semiconductors used are listed in Table 1.2.

Table 1.1 DATA SUMMARY

CHARACTERISTIC	SPECIFICATIONS
Noise Bandwidth:	±2 dB over the range 300Hz to 3.4kHz
RMS Noise Power Output:	0 dBm maximum (1mW in 600 ohms)
Attenuator range:	0 to -32 dBm (each channel) in 2 dB steps
Attenuator accuracy:	±0.25 dB incremental, 1 dB overall
Statistical Peak to RMS:	8 dB for 1% of time
Ratio of Noise Signal:	10 dB for 0.1% of time
Output impedance:	600 ohms balanced
POWER SUPPLY	
Supply voltage:	115/230V AC ±15%
Power Consumption:	20 watts

Table 1.1 DATA SUMMARY (continued)

CHARACTERISTIC	SPECIFICATIONS
DIMENSIONS:	Case suitable for bench use, or rack mounting Panel height: 7". Case depth: 12.5".
WEIGHT:	25 lbs (approx.)

Table 1.2 SEMICONDUCTOR COMPLEMENT

TYPE	QTY	TYPE	QTY
1N4001 Diode	2	2N3791 Transistor	1
1N4002 Diode	4	MPS4354 Transistor	1
1N4004 Diode	5	MPS6514 Transistor	24
1N5245B Diode	1	LM304H Integrated circuit	1
1N5337A Diode	1	LM3900N Integrated circuit	25
1N5415 Diode	1		
Noise Diode	12		

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Section 2

Operation

2. OPERATION

2.1 GENERAL

The instrument is shipped ready to operate, requiring no special installation procedures. Observe normal precautions against damage while unpacking. An instruction manual is supplied with each instrument.

2.2 INSTALLATION

For rack-mounting, refer to Fig. 2.1 for dimensions. The instrument requires either 115 or 230 volts nominal, single-phase at 50 to 60Hz, AC power and draws 20 watts.

NOTE: The instrument will be shipped ready for operation at 115V, unless otherwise specified. For operation at 230V, refer to paragraph 4.5.

Connect the power cable to an AC receptacle, preferably of the grounding type (3-pin). If a grounding receptacle is unavailable, use an AC adadapter.

2.3 OPERATING PROCEDURES

Paragraphs 2.4 through 2.10 describe the controls and connectors of Model TM7816A, and its operation in the field.

2.4 CONTROLS, CONNECTORS, AND INDICATORS

The operating controls, indicators, and connectors are shown in Fig. 3.1 and tabulated in Table 2.1.

Table 2.1 CONTROLS, CONNECTORS, AND INDICATORS

DESCRIPTION	FUNCTION
Power Supply Switch ON (S15)	Turns instrument on.
Power Indicator Light (LP1)	Indicates ON condition.
Attenuator dB switch (S13)	Controls level of noise from each output source. The amount of attenuation is indicated around the switch.
Output Jacks (J1 through J12)	3-conductor type; provide output for the twelve channels.
Channel ON switches (12) (S1 through S12)	These switch the output from each channel on and off.

Table 2.1 CONTROLS, CONNECTORS, AND INDICATORS (continued)

DESCRIPTION	FUNCTION
SET LEVEL presets (RV1 through RV12)	Enable the channel noise output to be preset at 0 dBm.
CHANNEL MONITORED switch (S14)	Selects the channel to be monitored on the output level meter.
Output Level Meter (M1)	Indicates output level from the channel selected by the CHANNEL MONITORED switch.
"Manual/Programmable" (cut-out)	Houses changeover switch when Remote Programming option is fitted. (Refer to Appendix A.)
NOTE: Cutout should be kept covered whenever Remote Programming option is not in use.	
ON REAR PANEL:	
Power Connection Socket, 3-way (SK13)	
Power Line Fuse, 1A (FS1)	
-18V Fuse, 1A (FS2)	
Line Voltage Select Switch (S17)	Selects desired voltage (115/230)
Rectangular Cut-Out	Houses multiway connector when Remote Programming option is fitted. (Refer to Appendix A.)

2.5 CONNECTION AND PRELIMINARY OPERATION

Make sure that the instrument is correctly adjusted for the voltage of the AC power applied. Normally dispatched ready for use with 115V power, the instrument can be adjusted for other voltages, as described in paragraph 4.5.

2.6 SETTING CHANNEL LEVEL

Set channel level as follows:

(a) Switch instrument ON and allow a warm-up time of 5 minutes.

(b) Set ATTENUATOR dB switch to "0."

(c) Set CHANNEL MONITORED switch to "1."

(d) Using a small screwdriver, adjust the SET LEVEL preset on channel 1 to give a reading of 0 dBm on the output level meter. This insures that with the attenuator set to "0", channel 1 is standardized to give 0 dBm RMS level into a balanc-

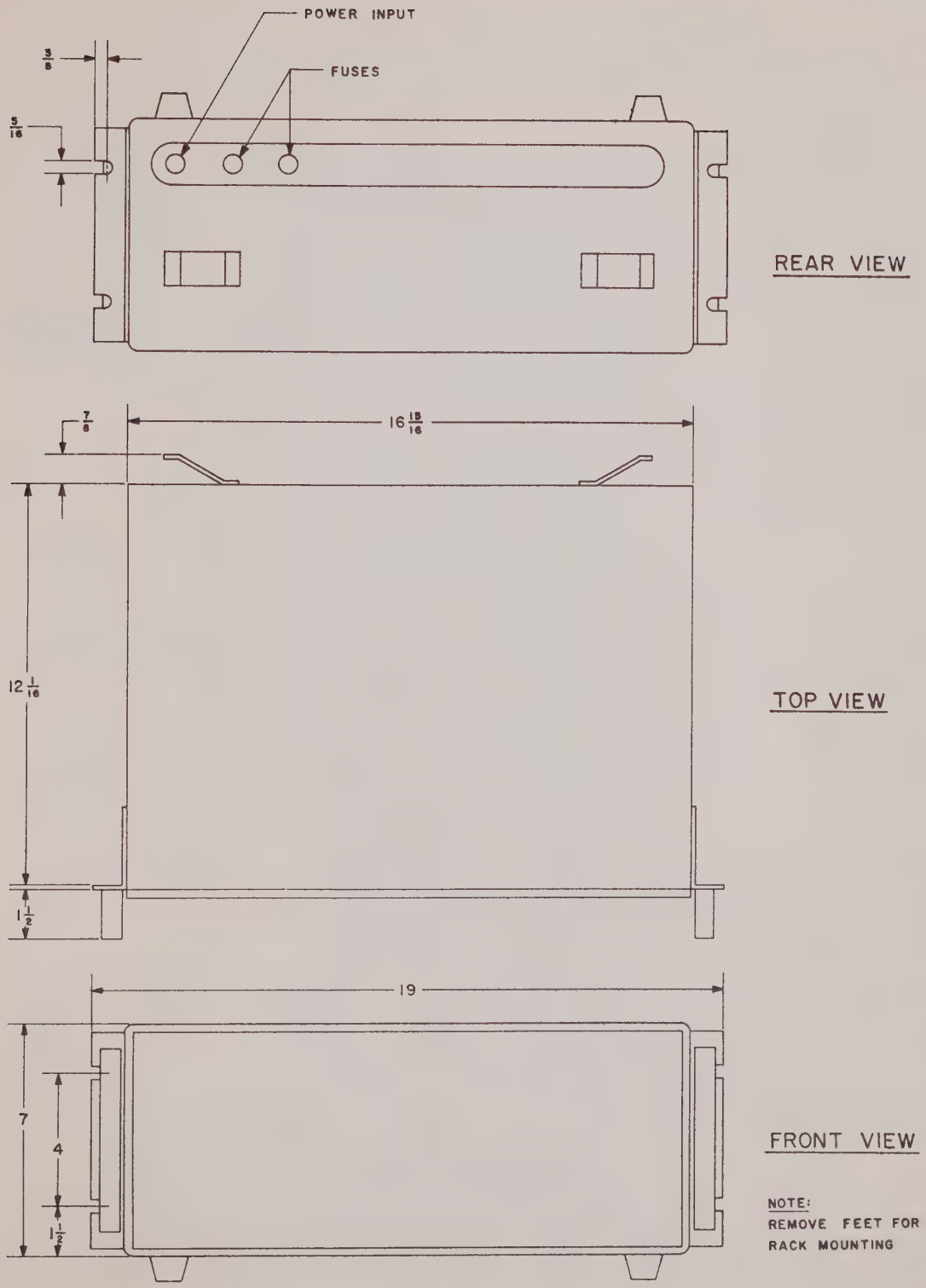


Fig. 2.1 Rack Mounting Installation Drawing

ed 600 ohm load connected to the appropriate jack.

(e) Repeat the above steps for each of the twelve channels. The instrument is now ready for use.

2.7 CONNECTION TO EQUIPMENT UNDER TEST

The instrument is designed for use with equipment having a 600-ohm balanced input impedance, therefore it is essential that a balanced 600-ohm load be used. The output jacks are of the ring, tip, and sleeve type. Standard 3-conductor patch cords can be used for connection to jacks.

In order to measure the effect of intermodulation and crosstalk, a level meter will be required, preferably calibrated in decibels referred to 1mW in 600 ohms, otherwise any AC voltmeter operating in the audio frequency range may be used. Voltage ratios can then be converted to decibels.

The method of connection to the equipment under test is shown in Fig. 2.3. Having connected all the input multiplex channels to the noise generator (TM7816A), a level meter is connected to one channel at the far end of the system and a level is measured. The corresponding channel at the sending end is now switched off, using the output switches on the noise generator (TM7816A) and the level meter then indicates the noise in that channel with all the other channels fully loaded.

The level of the noise in this "quiet" channel will be due to thermal system noise, receiver noise, intermodulation noise from the loaded channels and crosstalk in the "send" and "receive" multiplex from the other channels.

2.8 NOISE LOADING LEVEL

In order for the measurements as outlined in paragraph 2.7 to be meaningful, the correct level for the input noise must be determined; if the level is too high, intermodulation effects will be greater than those obtained under normal working conditions; if too low, then the thermal receiver and system noise will give an apparently worse signal-to-noise ratio than would occur in practice.

CCIR recommendations specify noise loading levels with respect to test-tone level (0 dBm0) for a multiplexed system of N channels. This ratio of noise loading level to test-tone level is referred to as the Noise Loading Ratio (NLR).

For Systems up to 240 Channels (which will be the case where the Model TM7816A is used):

$$NLR = -1 + 4 \log N \text{ dBm0}$$

This is the level derived from N separate channels.

The single-channel noise loading ratio will be:

$$(-1 + 4 \log N) - 10 \log N = -1 - 6 \log N$$

Taking two examples of 12 and 24 channels (the most likely to be used):

12 channels ... $-1 - 6 \log_{10} 12 = -7.48$ dBm0 per channel

24 channels ... $-1 - 6 \log_{10} 24 = -9.3$ dBm0 per channel

For Systems having more than 240 Channels:

$$NLR = -15 + 10 \log N \text{ dBm0}$$

"per channel" loading = $-15 + 10 \log N$ dBm0

= -15 dBm, irrespective of the number of channels.

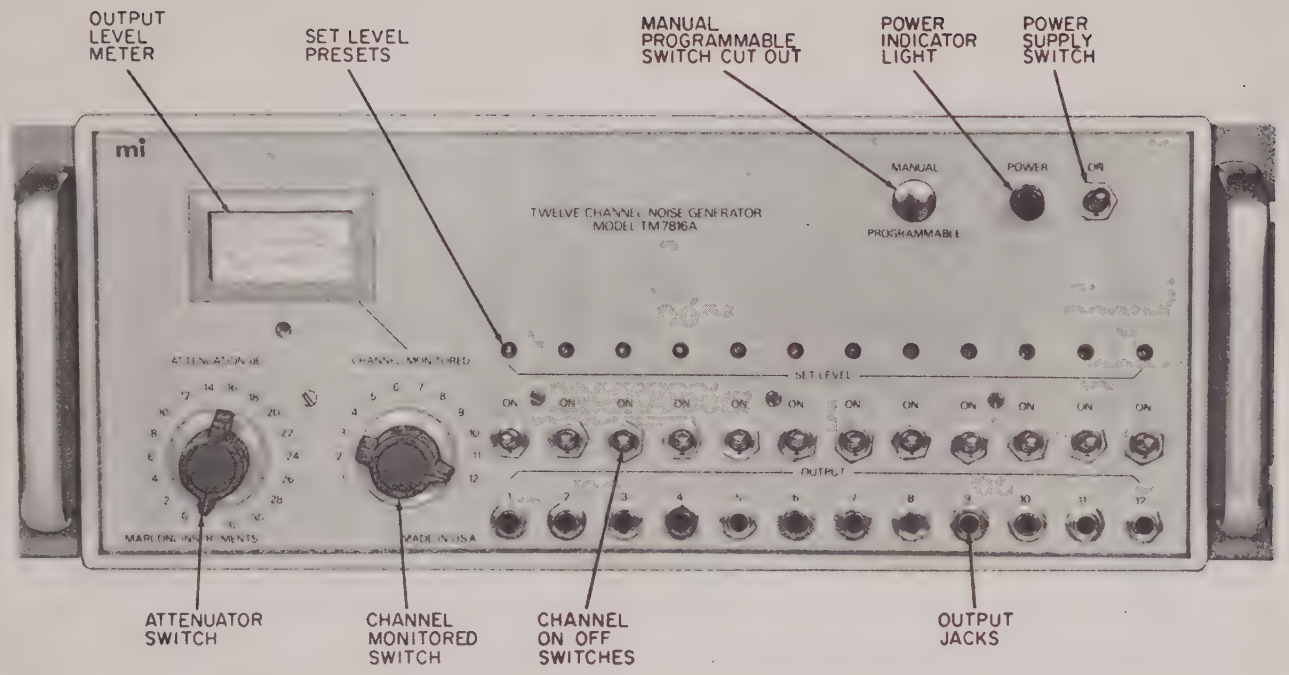


Fig. 2.2 Controls, Connectors, and Indicators

Fig. 2.3 Connections to Equipment Under Test

2.9 NOISE LEVEL MEASUREMENTS

Different specifications on systems call for different units of measurement to be used in the determination of unwanted noise in any one channel. Some may simply call for a signal-to-noise ratio under worst conditions (e.g. all channels fully loaded): others may call for the noise in the "quiet" channel to be specified in absolute units (e.g. picowatts).

Also, since different frequencies in the audio range cause different amounts of interference to the wanted information, weighting filters are often used in the Level Meter, in an attempt to estimate the "interfering value" of the unwanted noise. These filters may be FIA, C-message, or psophometrically weighted. The first of these found widespread use in the USA some years ago, but has now largely been replaced by the C-message filter. Psophometric weighting is commonly used in Europe.

When spurious noise levels must be so specified, the weighting filter will be inserted between the output of the system and the level meter. Under these conditions a true RMS level meter should be used. Alternatively, corrections may be applied to a peak-reading (sinewave RMS calibrated) AC voltmeter, which is generally more readily available.

Such corrections would cause this type of voltmeter to be read approximately 1.8 dB high with noise applied to it, - the correction giving the true RMS level of the signal.

Another term often used in this connection is "dBa." This refers to the level of FIA weighted noise above -85 dBm for a 1 kHz tone. For white noise, whose level is attenuated by 3 dB in an FIA filter, "dBa" refers to the level above -82 dBm.

For example:

15 dBa = -67 dBm (FIA) flat weighted.

Flat weighted noise applied to a C-message weighting filter is attenuated by 1.5 dB. The term "dBrnc" refers to C-message weighted measurements above -90 dBm (at 1 kHz) or -88.5 dBm for flat weighted noise.

10 dBrnc = -78.5 dBm, under these conditions (10 dBrnc0 = -78.5 dBm0)

The psophometric weighting filter attenuates flat weighted noise by 2.5 dB.

Note that 1 picowatt (1 pW) = 10^{-12} watt, or 0 dBm = 10^{9} picowatt.

2.10 MULTIPLEX EQUIPMENT TESTING

In this case the "send" and "receive" multiplex equipments are connected back-to-back and then considered as an overall system. Overloading points can be seen by increasing the input level, and noting the point at which the spurious noise in the "quiet" channel begins to rise faster than the input level. The attenuator on the Model TM7816A enables this level change to be made easily.

Crosstalk effects can be separated by switching off all the channels except both or either of the channels adjacent to the "quiet" channel. The spurious noise in the "quiet" channel is then measured by switching the adjacent channels off and on.

Under these conditions the total loading for the group of 12 channels will be very low, thus insuring that spurious contributions due to intermodulation will have a low, second-order effect.

Section 3

Technical description

3. TECHNICAL DESCRIPTION

3.1 GENERAL

The The twelve noise channels of the TM7816A are produced by 12 identical boards, each containing a solid-state noise source, operational amplifiers and output stage. Each board is associated with one section of the ganged, electro-mechanically operated attenuator.

3.2 DETAILED THEORY OF OPERATION

This is contained in paragraphs 3.3 through 3.6, and reference should be made to Figures 3.1 and 6.1 and figures referenced in the applicable paragraph.

3.3 NOISE SOURCE AND AMPLIFIER

The noise source in Model TM7816A is a solid-state device producing gaussian noise over a wide bandwidth. (See Figure 6.2.) On the noise generator board (A3), resistor R1 sets the operating current through the noise diode CR1, and resistor R2 is preselected to compensate for the differing noise performance between diodes. Operational amplifier U1(1) introduces a gain of 34 dB, and feeds the active low-pass filter built around operational amplifier U1(2). This section and the high-pass filter built around U1(4), constitute a band-pass network which limits the spectrum of the available noise to the range 300Hz to 3.4 kHz. Interaction between the two filter stages is eliminated by the buffer amplifier built around U1(3) which contributes a further 34 dB of gain, and is fed by the voltage divider composed of resistor R9 and the respective SET LEVEL control, variable resistors (RV1 through RV12).

The output from U1(4) is taken via the appropriate attenuator switch section to the operational amplifier U2(2) which contributes a gain of 20 dB and feeds the phase-splitting network U2(3) and U2(4). In order to obtain sufficient output-power, the emitter-follower transistors Q1 and Q2, are included between the phase-splitter and the output transformer T1.

The -9V bias for the operational amplifiers is provided by U2(1), operating as a voltage divider with low output impedance.

3.4 ATTENUATOR

The attenuator (Figure 6.5 gives details of the attenuator sections) consists of twelve separate sections, one for each of the twelve noise channels. In order to give an easy switching operation and good electrical location, the attenuator is driven by a rotary stepping solenoid and is remotely controlled by a single-section switch on the front panel. Each section of the attenuator contains 16 "L"-pad attenuators to provide a total of 32 dB.

The solenoid will drive the attenuator in only one direction (from high output to low output). In order to prevent full noise output being delivered as the "0" position is passed, relay K1 on component board A7, interrupts the -18V supply line when the attenuator is rotating.

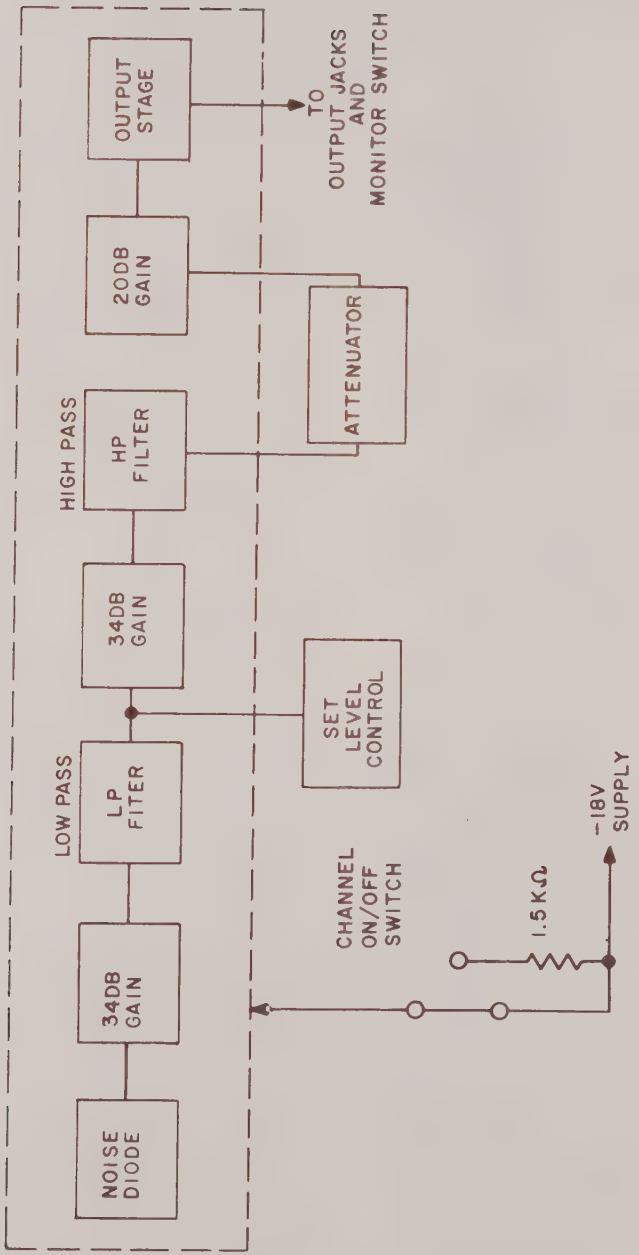


Fig. 3.1 Noise Generator Board, Block Diagram

3.5 MONITORING CIRCUIT

NOTE: Both Monitor and Power Supply circuits are contained on a single board. (See Figures 4.7 and 6.5.)

The level monitoring circuit is connected by the CHANNEL MONITORED switch to one side of the balanced output of any one of the output jacks (J1 through J12). The jacks are so wired, whether a plug (correctly terminated) is inserted or not, that a 600 ohms load is always presented to the outputs of the noise generator boards.

The noise signal applied to the monitor circuit is first routed to the amplifying stage formed by operational amplifier U1(4), and then via capacitor C2 and resistor R4 to the SET METER variable resistor RV13 (located on the main chassis next to the monitor board). A further stage of amplification is provided by operational amplifier U1(2) before the signal is fed to the meter via the full wave recifier diodes CR1 and CR2. The overall gain of the monitoring circuit is approximately 24 dB. Capacitor C4 acts as a damping capacitor to limit meter fluctuations due to the random nature of the input noise signal. Variable resistor RV13 controls meter sensitivity and is used to calibrate the monitoring circuit against a true RMS voltmeter. Note that, since the monitor responds only to peak amplitude, it can be checked only with a noise signal (such as internally generated noise) against the reading of a true RMS voltmeter.

3.6 POWER SUPPLY (See Figures 4.7, 5.3, and 6.6.)

The power transformer T1 is wired for either 100 to 130V or 200 to 250V AC operation as described in paragraph 4.5. The AC output is rectified by the bridge rectifier diodes CR6 through CR9, located on the component board (A7) and then fed to the regulator circuit contained on the Power Supply and Monitor Board. Regulation is performed by the integrated circuit U2, and adjustment of the stabilized -18V output is facilitated by resistor R14 (located for ease of accesibility at the upper edge of the Power Supply and Monitor Board).

Note also that the Component Board houses the bridge rectifier diodes CR1 through CR4 for the attenuator solenoid drive and the -18V interrupt relay K1. The board is mounted below the main chassis, toward the rear of the instrument.

Section 4

Maintenance

4. MAINTENANCE

4.1 GENERAL

This Section of the manual serves as a general guide to the maintenance of the instrument. Listed in this Section are the test equipments required, troubleshooting procedures, adjustment procedures, and illustrations showing component locations.

In case of difficulties which cannot be resolved with the aid of this manual, contact the Marconi Instruments Service Division, or your nearest Marconi engineering representative. Always give both type and serial number of the instrument.

4.2 TEST EQUIPMENT REQUIRED

Table 4.1 lists the test equipment required for complete testing and servicing. Equipment with equivalent characteristics may be used.

4.3 PRELIMINARY INSPECTION

Make a preliminary visual and manual inspection of the instrument before beginning any maintenance procedure. Remove the cover to inspect the interior; check for loose or damaged parts, evidence of overheating, blown fuses, dirt, oil, or grease. Correct such faults before proceding with maintenance.

CAUTION: The power transformer, the power fuse FS1, and the wiring between the attenuator control and the master attenuator switch carry power line voltage. Exercise care when investigating these areas of the instrument.

Table 4.1 TEST EQUIPMENT REQUIRED

INSTRUMENT	MANUFACTURER AND MODEL NO.	APPLICATION
Balanced to Unbalanced Transformer 600 Ohms	Marconi TM6221	Noise level checking
True RMS Voltmeter	HP 3400A	Noise output standardization
Sensitive Valve Voltmeter (AC)	Marconi TF2600	Attenuator checking
Wave Analyzer	Quan-Tech 304DL	Bandwidth and amplitude distribution checking
Volt-Ohm Meter (VOM)	Simpson 260	Voltage and resistance checking
Oscilloscope	HP 180C with 1806A plug-in	Waveform checking

4.4 REMOVAL OF CASE

The case is slid off toward the rear of the instrument after first disconnecting the power cord and four screws along the back of the case. The whole of the interior is now exposed.

4.5 POWER LINE VOLTAGE ADJUSTMENT

4.5.1 110 to 130 volt operation

For operation of a power line voltage in the range of 100 to 130V, set switch (S-17) to the 115V position, insert a AGC-1A fuse in FS1 position.

NOTE: The power line selector switch is located on the rear panel next to the fuses.

4.5.2 200 to 250 volt operation

For operation of a power line voltage in the range of 200 to 250V, remove Fuse FS1 and replace fuse with AGC-500mA fuse, set switch (S-17) to 230V position.

4.6 MINIMUM PERFORMANCE STANDARDS

The basic specification as given in Table 1.1 should be met. Minimum performance standards are listed in Table 4.2.

4.7 TROUBLESHOOTING

Troubleshooting procedures are given in Table 4.3. Where the location of the trouble is indefinite, start the procedure at a step most closely resembling the fault.

4.8 ACCESS TO COMPONENTS

NOTE: Switch off instrument and remove power cord before performing any disassembly.

Access to components on printed circuit boards is gained by simply withdrawing boards after removing the two retaining strips, held by screws. (The Component Board is located beneath the chassis as described in paragraph 3.6.)

Access to components on the master attenuator presents no problem if the components are mounted on the outside of the switch. For components mounted on the underside of the master attenuator, the mounting screws must be removed and attenuator swung outward, taking care not to damage the wiring.

Access to the row of preset potentiometers and wiring to the power switch and indicator light is gained by removing all the printed circuit boards and the forward board-guide panel. The whole of the front panel above the chassis is now accessible.

4.9 ADJUSTMENT AND CALIBRATION PROCEDURES

NOTE: The instrument should be adjusted for correct power-line operation and the supply voltage checked before beginning any adjustments or calibration.

4.9.1 Adjustment of attenuator control switch

The shaft of the attenuator control switch has no flat, and the knob (H1) may be secured in any position.

The switch has 18 positions of which only 17 are used. Maximum output occurs when the switch is in the "0 dBm" position and the unmarked

position. Having determined the two positions which give the greatest output, rotate the knob in a clockwise direction to the second of the two positions where the highest output is obtained ("0 dBm") and secure the knob.

4.9.2 Adjustment of output level

Connect the output of channel 1 as shown in Fig. 4.1. Set the attenuator to give maximum output. Adjust the SET LEVEL preset control to give 0 dBm (0.772V RMS) into 600 ohms. Repeat this procedure for each of the 12 outputs.

4.9.3 Adjustment of monitoring circuit

Having set the output of all channels to 0 dB, select any one channel with the CHANNEL MONITORED switch and adjust the Set Meter variable resistor RV13 (located on the main chassis next to the Power Supply and Monitor Board) until the level meter on the front panel reads exactly 0 dBm. This calibration should not be changed unless errors are suspected and located. If the Power Supply and Monitor Board is replaced at any time, the Set Meter variable resistor may require re-adjustment.

Table 4.2 MINIMUM PERFORMANCE STANDARDS

STEP	PURPOSE	PROCEDURE	NORMAL INDICATION	ABNORMAL INDICATION (REF)
1	Evaluate power operating conditions.	Connect instrument to power supply and switch ON.	Power indicator lamp (LP1) lights.	Check power ON switch, fuses, power cable, and power line voltage setting.(Refer to paragraph 4.5.)
2	Evaluate output noise level.	Turn all channel on/off switches to ON. Set attenuator to 0 dB and make connections as shown in Fig. 4.1.	Turn CHANNEL MONITORED switch to each channel in turn. LEVEL meter (M1) should indicate "0" on each channel.	Refer to paragraph 4.9 for adjustment, and Table 4.3, step 2 for repair.
3	Evaluate attenuator accuracy.	Make connections as shown in Fig. 4.1. Check attenuator against voltmeter reading for each channel in turn.	Attenuator agrees with voltmeter readings.	Refer to Table 4.3, step 4.
4	Evaluate bandwidth.	Make connections as shown in Fig. 4.1. Replace voltmeter with wave analyzer.	For each channel, bandwidth should be as shown in Fig. 4.2.	Refer to Table 4.3, step 6.

Table 4.2 MINIMUM PERFORMANCE STANDARDS (continued)

STEP	PURPOSE	PROCEDURE	NORMAL INDICATION	ABNORMAL INDICATION (REF)
5	Evaluate amplitude distribution.	Same as step 4.	For each channel, levels for 1% and 0.1% of time should be 8 and 10 dB down on RMS level.	Refer to Table 4.3, step 7.

Table 4.3 TROUBLESHOOTING PROCEDURES

STEP	PURPOSE	PROCEDURE	NORMAL INDICATION	FAULT LOCATION
1	Check -18V supply.	Set VOM for 25V range. Connect to pin H of Power Supply and Monitor Board.	-18V ±0.5V	Check -18V fuse FS2. If voltage is out of tolerance adjust resistor R14 on Power Supply and Monitor Board; or refer to Table 4.5.
2	Check output power of channel.	Make connections as shown in Fig. 4.1. Attenuator at "0."	0 dBm should be obtained in each channel.	Refer to paragraph 4.9 and to Table 4.5.
3	Check channel ON/OFF switches (S1 through S12).	Same as step 2. Switch channels off in turn.	Level in off condition should be -75 dBm or less.	Check switch. Check power supply (Step 1).
4	Check attenuator.	Refer to Table 4.2, step 3. Vary attenuator control.	Attenuator should be as indicated (within specifications) for each channel.	Check for faulty resistor on relevant section of attenuator.
5	Check meter circuit.	Make connections as shown in Fig. 4.1.	"0" on panel meter corresponds to 0 dBm on external RMS voltmeter.	Refer to paragraph 4.9.3 for adjustment. Check wiring and Power Supply and Monitor Board voltages. (Refer to Table 4.5.)

Table 4.3 TROUBLESHOOTING PROCEDURES (continued)

STEP	PURPOSE	PROCEDURE	NORMAL INDICATION	FAULT LOCATION
6	Check bandwidth of each channel.	Same as in Table 4.2, step 4.	Response similar to Fig. 4.2.	Replace board if spare is available. Check voltages by reference to Table 4.4.
7	Check amplitude distribution.	Same as in Table 4.2, step 5.	For 1% of the time, amplitude should be 8 dB below the RMS level, and for 0.1% of the time, amplitude should be 10 dB below the RMS level.	Replace board if spare is available. With connections as shown in Fig. 4.3, look at output on oscilloscope for evidence of clipping. Check voltages by reference to Table 4.4. If necessary, replace the noise diode, CR1.

Table 4.4 WORKING VOLTAGES FOR NOISE GENERATOR BOARD SA7816A.03B

(See Fig. 6.2.)

Voltages measured with digital voltmeter (Fluke Model 8000A, or equivalent).

NOTE: Tolerance is plus or minus 10 percent.

TEST POINT	VOLTAGE
Junction R1-CR1	-13.8
Output U1(1)	-8.4
Junction R5-R6	-13.1
Output U1(2)	-9.3
Output U1(3)	-8.5
Output U1(4)	-8.2
Pin 5 U2(1)	-9.0
Output U2(2)	-8.7
Output U2(3)	-8.4
Output U2(4)	-8.4
Emitter Q1	-9.0
Emitter Q2	-9.0

Table 4.4 WORKING VOLTAGES FOR NOISE GENERATOR BOARD SA7816A.03B (continued)

TEST POINT	VOLTAGE
Junction R24-T1	-12.6
Junction R26-T1	-12.6

Table 4.5 WORKING VOLTAGES FOR POWER SUPPLY AND MONITOR BOARD SA7816A.04A

(See Fig. 6.4.)

Voltages measured with digital voltmeter (Fluke Model 8000A, or equivalent).

NOTE: Tolerance is plus or minus 10 percent.

TEST POINT	VOLTAGE
Output U1(4)	-8.5
Output U1(2)	-8.5
Junction CR1-C10	-6.9

Table 4.5 WORKING VOLTAGES FOR POWER SUPPLY AND MONITOR BOARD SA7816A.04A (continued)

TEST POINT	VOLTAGE
Junction CR2-C9	-9.1
Meter output (pin E)	-9.1
Pin 5 U1(1)	-9.0
Rectified AC input (pin K)	-38.0
Junction CR5-C5	-34.0

Table 4.5 WORKING VOLTAGES FOR POWER SUPPLY AND MONITOR BOARD SA7816A.04A (continued)

TEST POINT	VOLTAGE
Junction CR4-R10	-15.8
Pin 2 U2(2)	-13.4
Collector Q1	-34.5
Emitter Q1	-18.5
Pin 1 U2(1)	-9.0

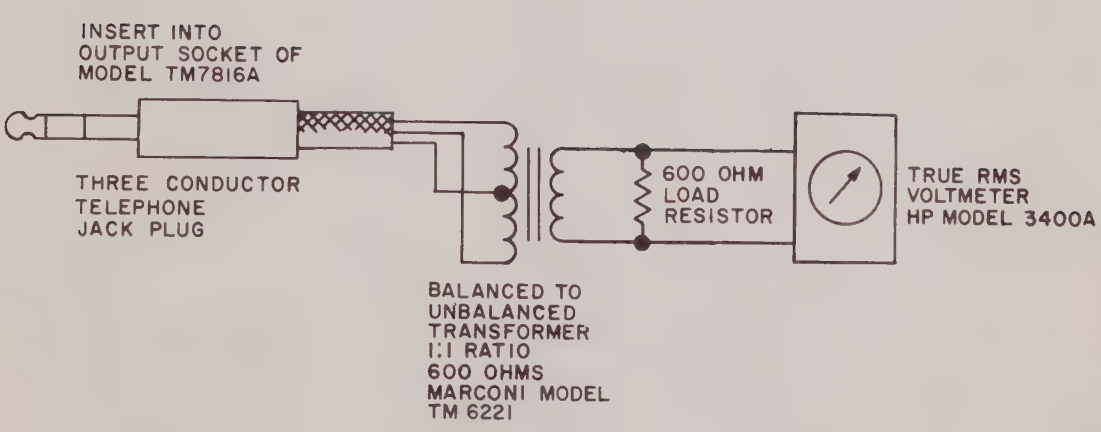


Fig. 4.1 Arrangement of Equipment for Maintenance

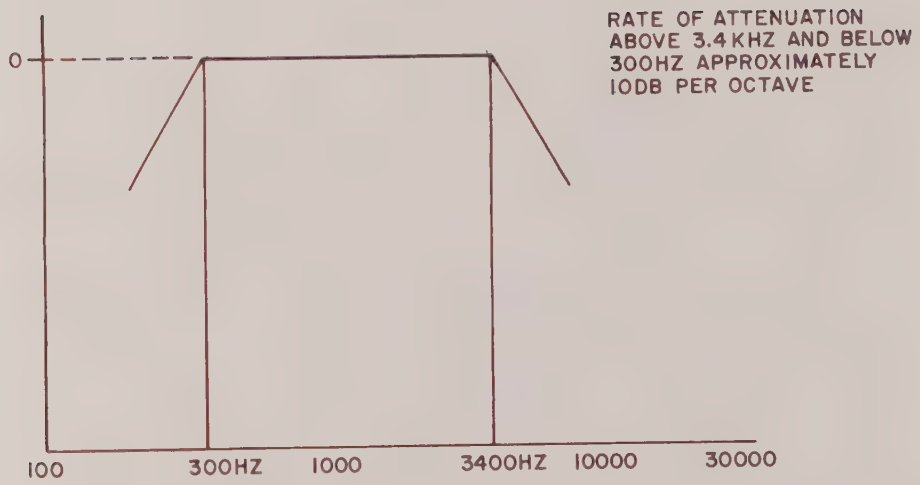


Fig. 4.2 Frequency Spectrum of One Channel

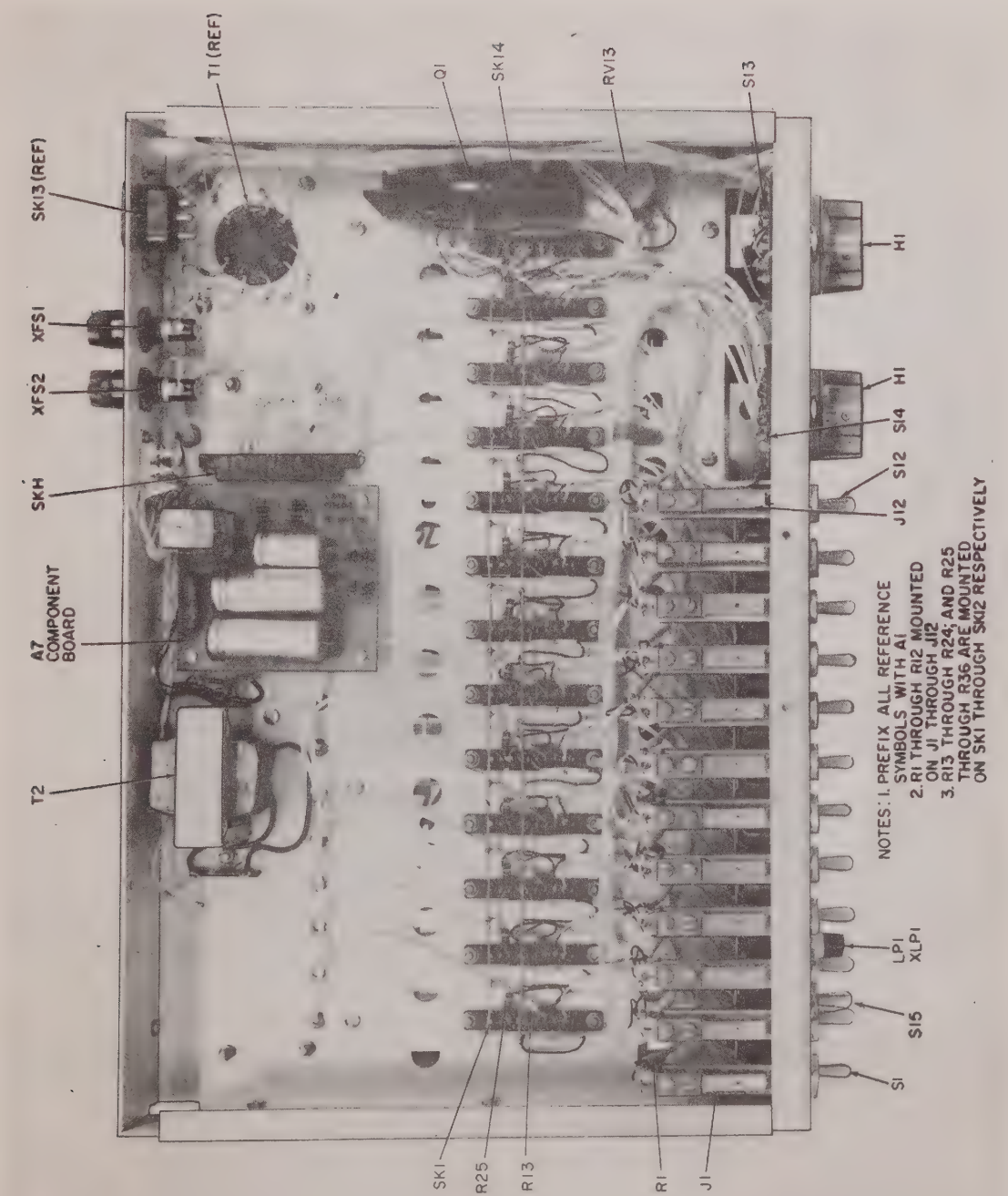


Fig. 4.3 Chassis, Bottom View

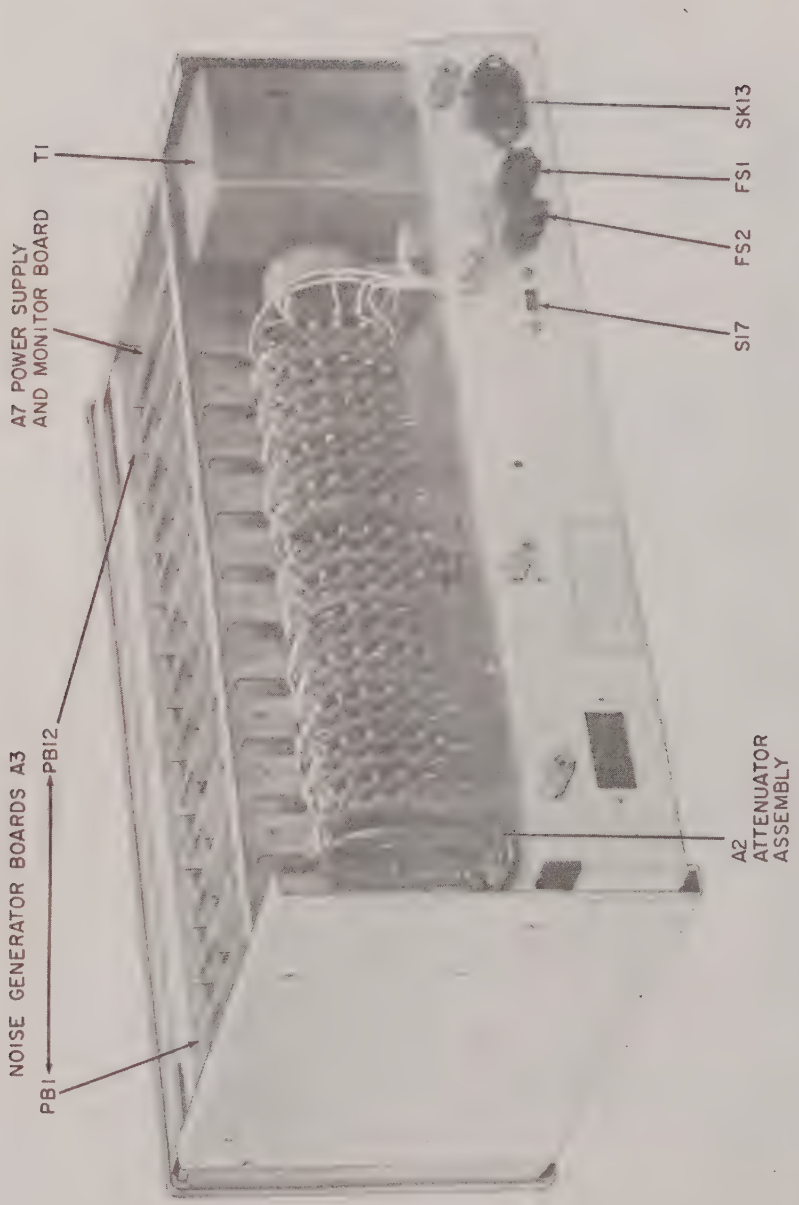


Fig. 4.4 Chassis, Top View

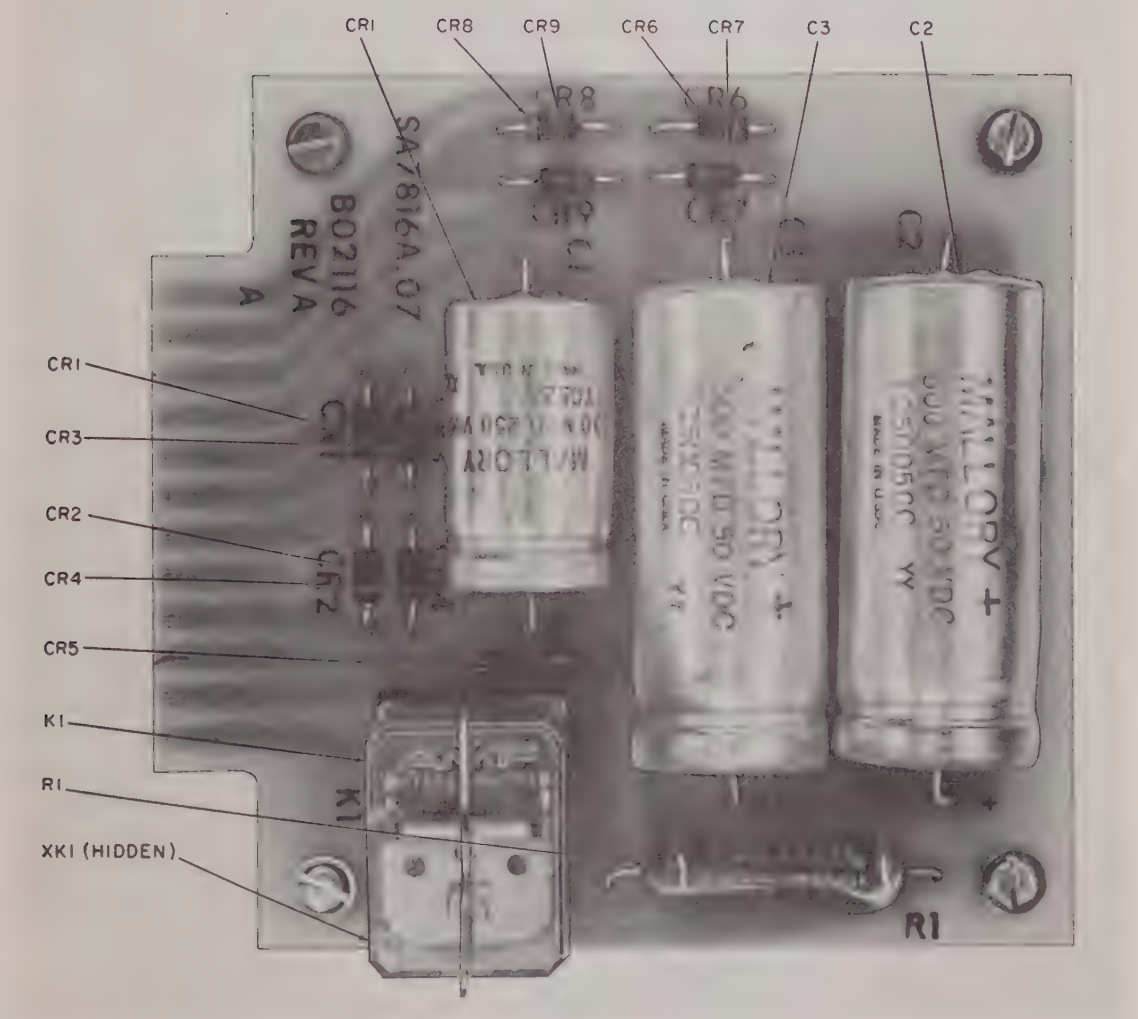


Fig. 4.5 Component Board, Parts Location

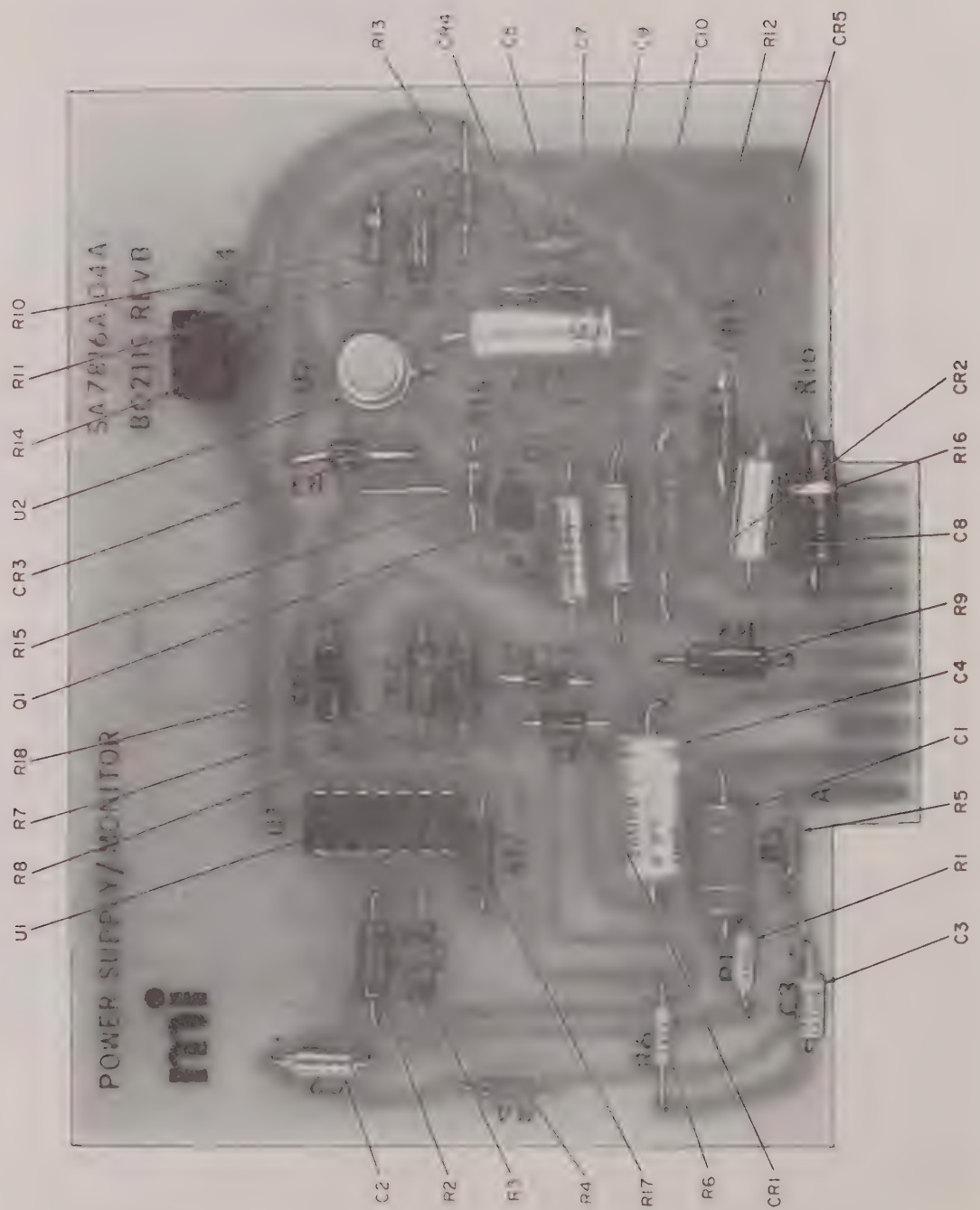


Fig. 4.6 Noise Generator Board, Parts Location

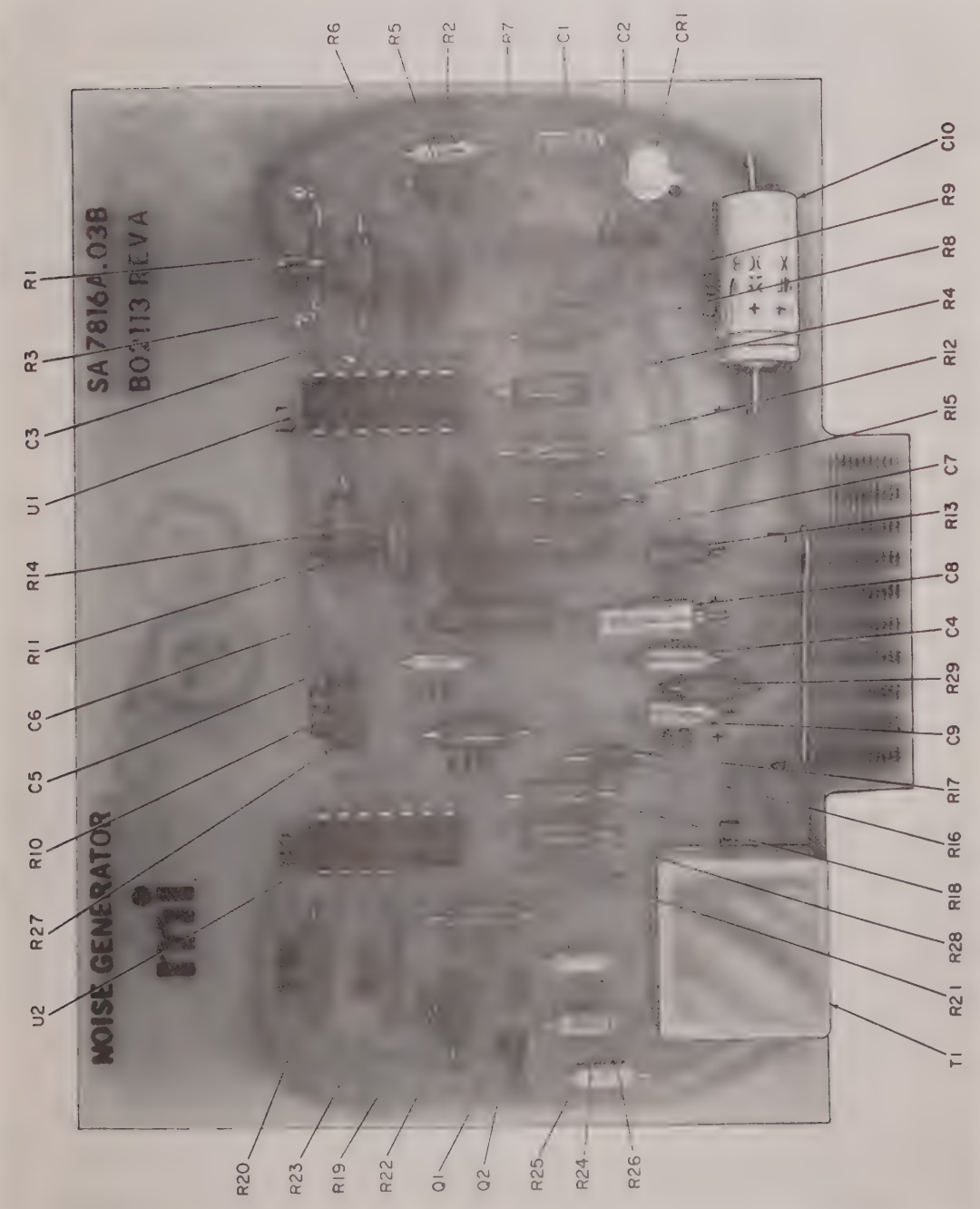


Fig. 4.7 Power Supply and Monitor Board, Parts Location

R2
R3
R4
R5
R6
NOTES:
1. RESISTORS ARE NUMBERED IDENTICALLY ON ALL 12 SWITCH SECTIONS IN CLOCKWISE ROTATION; R2 THROUGH R17.
2. SWITCH SECTIONS ARE NUMBERED FROM 1 TO 12, FROM FRONT TO REAR; EACH SECTION IS COMPOSED OF TWO WAFERS.
3. PREFIX ALL REFERENCE SYMBOLS WITH A2.
POSITION CONTROL WAFER
SLI SOLENOID DRIVE

Fig. 4.8 Attenuator Assembly, Parts Location

Section 5

Replaceable parts

5. REPLACEABLE PARTS

5.1 INTRODUCTION

The twelve channel noise generator consists of a number of major subassemblies each of which is allocated an identity number; in the sequence A1 to A7, omitting A5 and A6, as follows:

A1 - Main Chassis
A2 - Attenuator Assembly
A3 - Noise Generator Assembly (There are 12 identical noise generator boards)
A4 - Power Supply and Monitor Board Assembly
A7 - Component Board

5.2 The complete reference of a part consists of the subassembly number followed by its circuit reference, e.g. A4C5, A7R1, etc., and this should always be stated on any order, letter, etc. For convenience in the text and on circuit diagrams, the circuit reference is abbreviated by dropping the subassembly prefix except where there is a risk of ambiguity.

5.3 Replaceable parts are grouped in order of subassembly designation and itemized in alphanumerical order of circuit references with miscellaneous parts at the end of each list. The following abbreviations are used:

A	: assembly
C	: capacitor
Carb	: carbon
Cer	: ceramic
Comp	: composition
CR	: semiconductor diode, or metallic rectifier
Elect	: electrolytic
FS	: fuse
GMV	: guaranteed minimum value
L	: inductor
M	: meter
Met	: metal
Ox	: oxide
PCB	: printed circuit board
PL	: plug
Plas	: plastic
Q	: transistor
R	: resistor
RV	: variable resistor
S	: switch
SK	: socket
T	: transformer
Tant	: tantalum
U	: operational amplifier
Var	: variable or preset
WW	: wirewound
XFS	: fuseholder
W	: watt
†	: value selected during test; nominal value listed

5.4 ORDERING

When ordering replacement or spare parts, address the order to our Service Division (for address see back cover) or nearest representative. Please specify the following information for each part required:

(1) Type and serial number of instrument (see rear data plate).
(2) Complete circuit reference (see Introduction).
(3) Description.
(4) M.I. code number.

If a part is not listed, state its function, location and description when ordering.

ADDENDA

The Noise Generator Boards covered by this manual have been revised by the incorporation of the following engineering changes.

R10 Resistor has been changed in value from 20 K-ohms to 27.4 K-ohms (MI Code 24637A563).

C11 Mica Capacitor - 47 pF ±2%, 300V (MI Code 26272A303) has been added across resistor R11.

RT1 Thermistor - 68 K-ohms ±20% (MI Code 25683P487) has been added across revised resistor R10.

These changes will require revision to Figure 4.6 (page 28), Figure 6.2 (page 44), and the parts list on pages 36 and 37 in the next issue of this manual.

7816A(USA)
DEC 1974

A1— MAIN CHASSIS, 47816P101

When ordering, prefix circuit reference with A1.

NOTE: Marking of unit shows SA7816A.01.

Circuit reference	Description	M.I. code
FS1	Fuse, quick acting, 1 amp (3AG)	23411B006
FS2	Fuse, quick acting, 1 amp (3AG)	23411B006
H1	Knob, plastic	41145-202
H2	Foot, plastic	22315A663
J1	Jack, 3 conductor	23421A684
J2	Jack, 3 conductor	23421A684
J3	Jack, 3 conductor	23421A684
J4	Jack, 3 conductor	23421A684
J5	Jack, 3 conductor	23421A684
J6	Jack, 3 conductor	23421A684
J7	Jack, 3 conductor	23421A684
J8	Jack, 3 conductor	23421A684
J9	Jack, 3 conductor	23421A684
J10	Jack, 3 conductor	23421A684
J11	Jack, 3 conductor	23421A684
J12	Jack, 3 conductor	23421A684
LP1	Lamp, pilot	23735A294
M1	Meter, moving coil, 1 mA	44515Q001
PB1	Noise generator PCB (see A3 parts listing)	47816P301
PB2	Noise generator PCB (see A3 parts listing)	47816P301
PB3	Noise generator PCB (see A3 parts listing)	47816P301
PB4	Noise generator PCB (see A3 parts listing)	47816P301
PB5	Noise generator PCB (see A3 parts listing)	47816P301
PB6	Noise generator PCB (see A3 parts listing)	47816P301
PB7	Noise generator PCB (see A3 parts listing)	47816P301

When ordering, prefix circuit reference with A1.

Circuit reference	Description	M.I. code
PB8	Noise generator PCB (see A3 parts listing)	47816P301
PB9	Noise generator PCB (see A3 parts listing)	47816P301
PB10	Noise generator PCB (see A3 parts listing)	47816P301
PB11	Noise generator PCB (see A3 parts listing)	47816P301
PB12	Noise generator PCB (see A3 parts listing)	47816P301
PB13	Power supply and monitor PCB (see A4 parts listing)	47816P401
PB14	Component board (see A7 parts listing)	47816P701
Q1	Transistor	24834P879
R1 *	Resistor, fixed, comp, ±2%, 1/4 W	24636B802
R2	Resistor, fixed, comp, ±2%, 1/4 W	24636B802
R3	Resistor, fixed, comp, ±2%, 1/4 W	24636B802
R4	Resistor, fixed, comp, ±2%, 1/4 W	24636B802
R5	Resistor, fixed, comp, ±2%, 1/4 W	24636B802
R6	Resistor, fixed, comp, ±2%, 1/4 W	24636B802
R7	Resistor, fixed, comp, ±2%, 1/4 W	24636B802
R8	Resistor, fixed, comp, ±2%, 1/4 W	24636B802
R9	Resistor, fixed, comp, ±2%, 1/4 W	24636B802
R10	Resistor, fixed, comp, ±2%, 1/4 W	24636B802
R11	Resistor, fixed, comp, ±2%, 1/4 W	24636B802
R12	Resistor, fixed, comp, ±2%, 1/4 W	24636B802

* **Components R1 through R12 have value 604Ω**

For symbols and abbreviations see introduction to this section.

When ordering, prefix circuit reference with A1.

Circuit reference	Description	M.I. code
R13	Resistor, fixed, film, 1.82 K-ohms, ±1%, 1/4 W	24637A139
R14	Resistor, fixed, film, 1.82 K-ohms, ±1%, 1/4 W	24637A139
R15	Resistor, fixed, film, 1.82 K-ohms, ±1%, 1/4 W	24637A139
R16	Resistor, fixed, film, 1.82 K-ohms, ±1%, 1/4 W	24637A139
R17	Resistor, fixed, film, 1.82 K-ohms, ±1%, 1/4 W	24637A139
R18	Resistor, fixed, film, 1.82 K-ohms, ±1%, 1/4 W	24637A139
R19	Resistor, fixed, film, 1.82 K-ohms, ±1%, 1/4 W	24637A139
R20	Resistor, fixed, film, 1.82 K-ohms, ±1%, 1/4 W	24637A139
R21	Resistor, fixed, film, 1.82 K-ohms, ±1%, 1/4 W	24637A139
R22	Resistor, fixed, film, 1.82 K-ohms, ±1%, 1/4 W	24637A139
R23	Resistor, fixed, film, 1.82 K-ohms, ±1%, 1/4 W	24637A139
R24	Resistor, fixed, film, 1.82 K-ohms, ±1%, 1/4 W	24637A139
R25	Resistor, fixed, comp, 1.5 K-ohms, ±10%, 1/2 W	24342A084
R26	Resistor, fixed, comp, 1.5 K-ohms, ±10%, 1/2 W	24342A084
R27	Resistor, fixed, comp, 1.5 K-ohms, ±10%, 1/2 W	24342A084

When ordering, prefix circuit reference with A1.

Circuit reference	Description	M.I. code
R28	Resistor, fixed, comp, 1.5 K-ohms, ±10%, 1/2 W	24342A084
R29	Resistor, fixed, comp, 1.5 K-ohms, ±10%, 1/2 W	24342A084
R30	Resistor, fixed, comp, 1.5 K-ohms, ±10%, 1/2 W	24342A084
R31	Resistor, fixed, comp, 1.5 K-ohms, ±10%, 1/2 W	24342A084
R32	Resistor, fixed, comp, 1.5 K-ohms, ±10%, 1/2 W	24342A084
R33	Resistor, fixed, comp, 1.5 K-ohms, ±10%, 1/2 W	24342A084
R34	Resistor, fixed, comp, 1.5 K-ohms, ±10%, 1/2 W	24342A084
R35	Resistor, fixed, comp, 1.5 K-ohms, ±10%, 1/2 W	24342A084
R36	Resistor, fixed, comp, 1.5 K-ohms, ±10%, 1/2 W	24342A084
RV1	Resistor, var, comp, 2.5 K-ohms, ±10%, 1/4 W	25615A253
RV2	Resistor, var, comp, 2.5 K-ohms, ±10%, 1/4 W	25615A253
RV3	Resistor, var, comp, 2.5 K-ohms, ±10%, 1/4 W	25615A253
RV4	Resistor, var, comp, 2.5 K-ohms, ±10%, 1/4 W	25615A253
RV5	Resistor, var, comp, 2.5 K-ohms, ±10%, 1/4 W	25615A253
RV6	Resistor, var, comp, 2.5 K-ohms, ±10%, 1/4 W	25615A253

For symbols and abbreviations see introduction to this section.

When ordering, prefix circuit reference with A1.

Circuit reference	Description	M.I. code
RV7	Resistor, var, comp, 2.5 K-ohms, ±10%, 1/4 W	25615A253
RV8	Resistor, var, comp, 2.5 K-ohms, ±10%, 1/4 W	25615A253
RV9	Resistor, var, comp, 2.5 K-ohms, ±10%, 1/4 W	25615A253
RV10	Resistor, var, comp, 2.5 K-ohms, ±10%, 1/4 W	25615A253
RV11	Resistor, var, comp, 2.5 K-ohms, ±10%, 1/4 W	25615A253
RV12	Resistor, var, comp, 2.5 K-ohms, ±10%, 1/4 W	25615A253
RV13	Resistor, var, comp, 500 ohms, ±20%, 2 W	25644A614
S1	Switch, toggle, DPDT	44334A003
S2	Switch, toggle, DPDT	44334A003
S3	Switch, toggle, DPDT	44334A003
S4	Switch, toggle, DPDT	44334A003
S5	Switch, toggle, DPDT	44334A003
S6	Switch, toggle, DPDT	44334A003
S7	Switch, toggle, DPDT	44334A003
S8	Switch, toggle, DPDT	44334A003
S9	Switch, toggle, DPDT	44334A003
S10	Switch, toggle, DPDT	44334A003
S11	Switch, toggle, DPDT	44334A003
S12	Switch, toggle, DPDT	44334A003
S13	Switch, rotary, 2 pole, 18 way	44321P013
S14	Switch, rotary, 1 pole, 12 way	44321P014
S15	Switch, toggle, DPDT	44334A003
S16	Attenuator assembly [see A2 parts listing (SA7816A.02)]	47816P201
S17	Switch, line voltage select	23467B119
SK1	Socket, printed circuit, 10 way	23435A048
SK2	Socket, printed circuit, 10 way	23435A048

When ordering, prefix circuit reference with A1.

Circuit reference	Description	M.I. code
SK3	Socket, printed circuit, 10 way	23435A048
SK4	Socket, printed circuit, 10 way	23435A048
SK5	Socket, printed circuit, 10 way	23435A048
SK6	Socket, printed circuit, 10 way	23435A048
SK7	Socket, printed circuit, 10 way	23435A048
SK8	Socket, printed circuit, 10 way	23435A048
SK9	Socket, printed circuit, 10 way	23435A048
SK10	Socket, printed circuit, 10 way	23435A048
SK11	Socket, printed circuit, 10 way	23435A048
SK12	Socket, printed circuit, 10 way	23435A048
SK13	Socket, power input	23423B151
SK14	Socket, printed circuit, 12 way	23435P050
T1	Transformer, power	43456P001
T2	Transformer, isolation	43456P002
XFS1	Fuseholder	23416P101
XFS2	Fuseholder	23416P101
XPL1	Lampholder	23746P701

Accessories Supplied

Linecord	23424A158

A2— ATTENUATOR ASSEMBLY, 47816P201

When ordering, prefix circuit reference with A2.

NOTE: Marking of unit shows SA7816A.02.

R1	Not used	
R2	Resistor, fixed, film, 5.62 K-ohms, ±1%, 1/4 W	24637A313

For symbols and abbreviations see introduction to this section.

When ordering, prefix circuit reference with A2.

Circuit reference	Description	M.I. code
R3	Resistor, fixed, film, 2.49 K-ohms, ±1%, 1/4 W	24637P202
R4	Resistor, fixed, film, 1.47 K-ohms, ±1%, 1/4 W	24637P112
R5	Resistor, fixed, film, 971 ohms, ±1%, 1/4 W	24637P950
R6	Resistor, fixed, film, 681 ohms, ±1%, 1/4 W	24636A825
R7	Resistor, fixed, film, 499 ohms, ±1%, 1/4 W	24636A820
R8	Resistor, fixed, film, 374 ohms, ±1%, 1/4 W	24636A723
R9	Resistor, fixed, film, 280 ohms, ±1%, 1/4 W	24636A725
R10	Resistor, fixed, film, 215 ohms, ±1%, 1/4 W	24636P604
R11	Resistor, fixed, film, 165 ohms, ±1%, 1/4 W	24636P620
R12	Resistor, fixed, film, 127 ohms, ±1%, 1/4 W	24637P619
R13	Resistor, fixed, film, 100 ohms, ±1%, 1/4 W	24637A101
R14	Resistor, fixed, film, 78.7 ohms, ±1%, 1/4 W	24636P355
R15	Resistor, fixed, film, 61.9 ohms, ±1%, 1/4 W	24636P353
R16	Resistor, fixed, film, 48.7 ohms, ±1%, 1/4 W	24636P249
R17	Resistor, fixed, film, 38.3 ohms, ±1%, 1/4 W	24636P229

A3— NOISE GENERATOR, 47816P301

When ordering, prefix circuit reference with A3.

NOTE: Marking of unit shows SA7816A.03B.

Circuit reference	Description	M.I. code
C1	Capacitor, fixed, tant, 1.2 mFd, ±10%, 20 V	26486Q524
C2	Capacitor, fixed, mica, 820 pFd, ±2%, 100 V	26258P157
C3	Capacitor, fixed, mica, 100 pFd, ±2%, 100 V	26252P433
C4	Capacitor, fixed, tant, 1.2 mFd, ±10%, 20 V	26486Q524
C5	Capacitor, fixed, mica, 1600 pFd, ±2%, 100 V	26268P364
C6	Capacitor, fixed, mica, 1600 pFd, ±2%, 100 V	26268P364
C7	Capacitor, fixed, mica, 1600 pFd, ±2%, 100 V	26268P364
C8	Capacitor, fixed, tant, 10 mFd, ±10%, 20 V	26482B314
C9	Capacitor, fixed, tant, 1.2 mFd, ±10%, 20 V	26486Q524
C10	Capacitor, fixed, elect, 100 mFd, +75%-10%, 25 V	26417A154
CR1	Diode, semiconductor	44521B209
Q1	Transistor	28455P421
Q2	Transistor	28455P421
R1	Resistor, fixed, comp, 68 K-ohms, ±10%, 1/4 W	24333A131
R2	Resistor, fixed, comp, 68 K-ohms, ±10%, 1/4 W	24333A131
R3	Resistor, fixed, film, 1 M-ohm, ±1%, 1/4 W	24637A901

For symbols and abbreviations see introduction to this section.

When ordering, prefix circuit reference with A3.

Circuit reference	Description	M.I. code
R4	Resistor, fixed, film, 1 M-ohm, ±1%, 1/4 W	24637A901
R5	Resistor, fixed, film, 232 K-ohms, ±1%, 1/4 W	24637A710
R6	Resistor, fixed, film, 118 K-ohms, ±1%, 1/4 W	24655P703
R7	Resistor, fixed, film, 232 K-ohms, ±1%, 1/4 W	24637A710
R8	Resistor, fixed, film, 232 K-ohms, ±1%, 1/4 W	24637A710
R9	Resistor, fixed, film, 12.1 K-ohms, ±1%, 1/4 W	24637P513
R10	Resistor, fixed, film, 20 K-ohms, ±1%, 1/4 W	24637A510
R11	Resistor, fixed, film, 1 M-ohm, ±1%, 1/4 W	24637A901
R12	Resistor, fixed, film, 1 M-ohm, ±1%, 1/4 W	24637A901
R13	Resistor, fixed, film, 165 K-ohms, ±1%, 1/4 W	24637P707
R14	Resistor,fixed, film, 1 M-ohm, ±1%, 1/4 W	24637A901
R15	Resistor, fixed, film, 1 M-ohm, ±1%, 1/4 W	24637A901
R16	Resistor, fixed, film, 100 K-ohms, ±1%, 1/4 W	24637A701
R17	Resistor, fixed, film, 1 M-ohm, ±1%, 1/4 W	24637A901
R18	Resistor, fixed, film, 1 M-ohm, ±1%, 1/4 W	24637A901

When ordering, prefix circuit reference with A3.

Circuit reference	Description	M.I. code
R19	Resistor, fixed, film, 1 M-ohm, ±1%, 1/4 W	24637A901
R20	Resistor, fixed, film, 1 M-ohm, ±1%, 1/4 W	24637A901
R21	Resistor, fixed, film, 499 K-ohms, ±1%, 1/4 W	24655P801
R22	Resistor, fixed, film, 1 M-ohm, ±1%, 1/4 W	24637A901
R23	Resistor, fixed, film, 1 M-ohm, ±1%, 1/4 W	24637A901
R24	Resistor, fixed, film, 287 ohms, ±1%, 1/4 W	24636A724
R25	Resistor, fixed, film, 221 ohms, ±1%, 1/4 W	24636A629
R26	Resistor, fixed, film, 287 ohms, ±1%, 1/4 W	24636A724
R27	Resistor, fixed, film, 487 K-ohms, ±1%, 1/4 W	24655A798
R28	Resistor, fixed, film, 1 M-ohm, ±1%, 1/4 W	24637A901
R29	Resistor, fixed, film, 9.09 K-ohms, ±1%, 1/4 W	24637P403
T1	Coil assembly	43456P301
U1	Integrated circuit	28461Q498
U2	Integrated circuit	28461Q498
	Terminal, forked	23233P217

A4—POWER SUPPLY AND MONITOR BOARD, 47816P401

When ordering, prefix circuit reference with A4.

NOTE: Marking of unit shows SA7816A.04A

C1	Capacitor, fixed, plas, 0.1 mFd, ±10%, 80 V	26582C208

For symbols and abbreviations see introduction to this section.

When ordering, prefix circuit reference with A4.

Circuit reference	Description	M.I. code
C2	Capacitor, fixed, tant, 1.2 mFd, ±10%, 20 V	26486Q524
C3	Capacitor, fixed, tant, 1.2 mFd, ±10%, 20 V	26486Q524
C4	Capacitor, fixed, elect, 100 mFd, +75% -10%, 6 V	26417B154
C5	Capacitor, fixed, cer, 0.01 mFd, ±20%, 100 V	26383A055
C6	Not used	
C7	Capacitor, fixed, elect, 10 mFd, +75% -10%, 12 V	26415B120
C8	Capacitor, fixed, tant, 10 mFd, ±10%, 20 V	26482B314
C9	Capacitor, fixed, tant, 4.7 mFd, ±10%, 15 V	26486B219
C10	Capacitor, fixed, tant, 4.7 mFd, ±10%, 15 V	26486B219
CR1	Diode, semiconductor	28355-166
CR2	Diode, semiconductor	28355-166
CR3	Diode, semiconductor	28357P044
CR4	Diode, semiconductor	28357Q044
CR5	Diode, semiconductor	28372C300
Q1	Transistor	28431Q767
R1	Resistor, fixed, film, 182 K-ohms, ±1%, 1/4 W	24637A708
R2	Resistor, fixed, film, 1 M-ohm, ±1%, 1/4 W	24637A901
R3	Resistor, fixed, film, 1 M-ohm, ±1%, 1/4 W	24637A901
R4	Resistor, fixed, film, 3.01 K-ohms, ±1%, 1/4 W	24637P204
R5	Resistor, fixed, film, 1 K-ohm, ±1%, 1/4 W	24637C101

When ordering, prefix circuit reference with A4.

Circuit reference		
R6	Resistor, fixed, film, 340 K-ohms, ±1%, 1/4 W	24637A711
R7	Resistor, fixed, film, 1 M-ohm, ±1%, 1/4 W	24637A901
R8	Resistor, fixed, film, 1 M-ohm, ±1%, 1/4 W	24637A901
R9	Resistor, fixed, film, 4.64 K-ohms, ±1%, 1/4 W	24637P208
R10	Resistor, fixed, comp, 1.8 K-ohms, ±10%, 1/4 W	24342A089
R11	Resistor, fixed, film, 2.43 K-ohms, ±1%, 1/4 W	24637A121
R12	Resistor, fixed, WW, 0.47 ohm, ±10%, 3 W	25135P051
R13	Resistor, fixed, film, 8.25 K-ohms, ±1%, 1/4 W	24637A404
R14	Resistor, var, cer, 2 K-ohms, ±20%, 1/4 W	25711B547
R15	Resistor, fixed, comp, 10 K-ohms, ±10%, 1/4 W	24899P110
R16	Resistor, fixed, comp, 1 K-ohm, ±10%, 1 W	24354A180
R17	Resistor, fixed, film, 1 M-ohm, ±1%, 1/4 W	24637A901
R18	Resistor, fixed, film, 487 K-ohms, ±1%, 1/4 W	24655A798
U1	Integrated circuit	28461Q498
U2	Integrated circuit	28461P702

For symbols and abbreviations see introduction to this section.

A7—COMPONENT BOARD, 47816P701

When ordering, prefix circuit reference with A7.

NOTE: Marking of unit shows SA7816A.07.

Circuit reference	Description	M.I. code
C1	Capacitor, fixed, elect, 10 mFd, +100% -10%, 250 V	26423B209
C2	Capacitor, fixed, elect, 500 mFd, +50% -10%, 50 V	26417B175
C3	Capacitor, fixed, elect, 500 mFd, +50% -10%, 50 V	26417B175
CR1	Diode, semiconductor	28357-028

When ordering, prefix circuit reference with A7.

Circuit reference	Description	M.I. code
CR2	Diode, semiconductor	28357-028
CR3	Diode, semiconductor	28357-028
CR4	Diode, semiconductor	28357-028
CR5	Diode, semiconductor	28357-028
CR6	Diode, semiconductor	28355-716
CR7	Diode, semiconductor	28355-716
CR8	Diode, semiconductor	28355-716
CR9	Diode, semiconductor	28355-716
K1	Relay	23486Q123
R1	Resistor, fixed, WW, 6 ohms, ±5%, 5 W	25127P605
XK1	Socket and retainer, relay	23486P274

For symbols and abbreviations see introduction to this section.

Circuit diagrams

6. CIRCUIT DIAGRAMS

6.1 GENERAL

This Section contains the circuit diagrams of the various assemblies used in the Model TM7816A. These diagrams will assist in understanding the operation of the unit as described in Section 3, and in conjunction with the tables of voltages in Section 4, will facilitate troubleshooting and maintenance.

6.2 COMPONENT VALUES

Resistors: No suffix = ohms, k = kilohms, M = megohms.
Capacitors: No suffix = microfarads, p = picofarads.

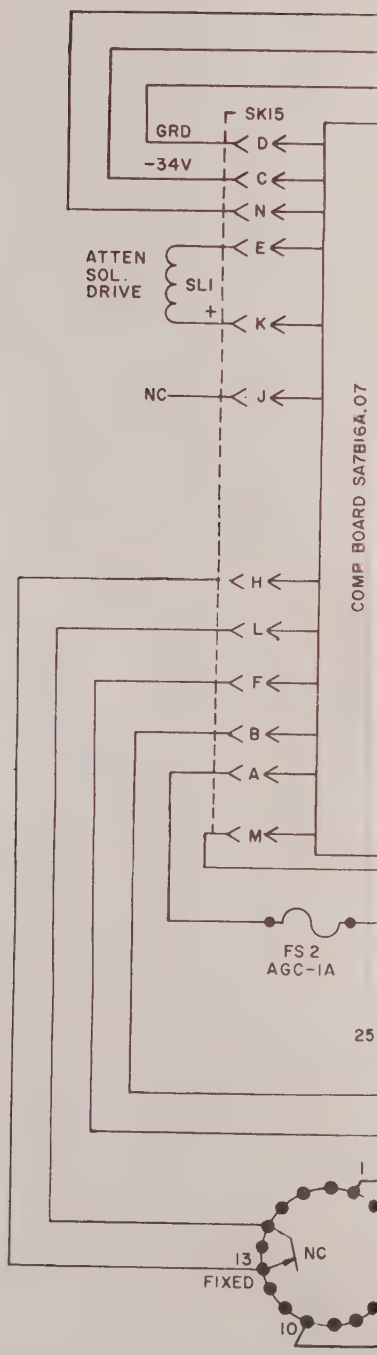
* Value selected during test: nominal value shown.

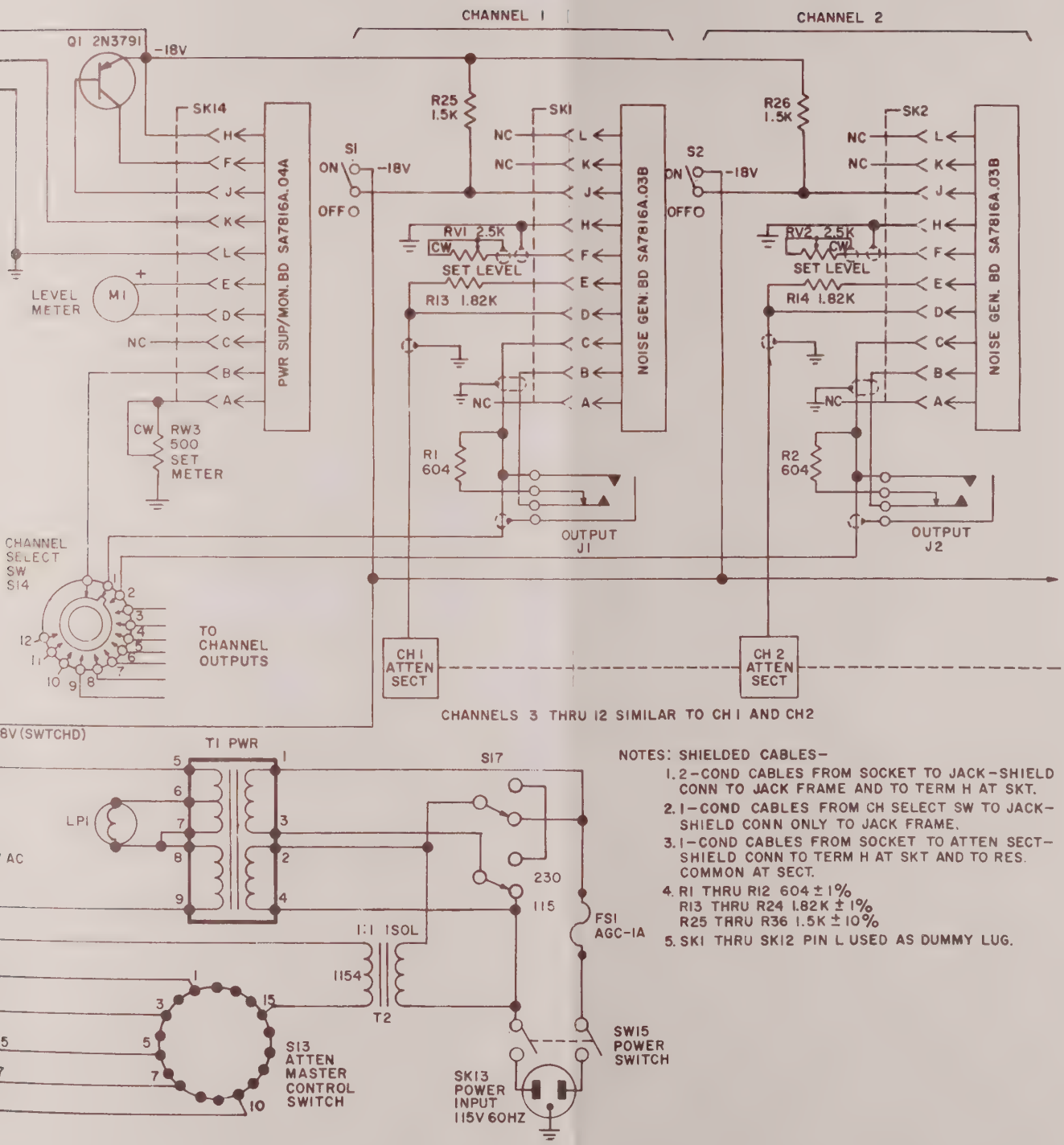
6.3 VOLTAGES

These are DC and relative to the chassis unless otherwise noted.

6.4 SWITCHES

Rotary switches are drawn schematically. Numbers indicate control knob setting.


SK15
GRD
D
-34V
C
N
E
ATTEN
SOL.
DRIVE
SL1
+
K
NC
J
COMP BOARD SA7B16A.07
H
L
F
B
A
M
FS 2
AGC-1A
25
1
13
NC
FIXED
10



NOTES: SHIELDED CABLES–

1. 2-COND CABLES FROM SOCKET TO JACK-SHIELD CONN TO JACK FRAME AND TO TERM H AT SKT.
2. 1-COND CABLES FROM CH SELECT SW TO JACK-SHIELD CONN ONLY TO JACK FRAME.
3. 1-COND CABLES FROM SOCKET TO ATTEN SECT-SHIELD CONN TO TERM H AT SKT AND TO RES. COMMON AT SECT.
4. R1 THRU R12 604 ± 1%
   R13 THRU R24 1.82K ± 1%
   R25 THRU R36 1.5K ± 10%
5. SK1 THRU SK12 PIN L USED AS DUMMY LUG.

Fig. 6.1 Model TM7816A, Overall Schematic Diagram

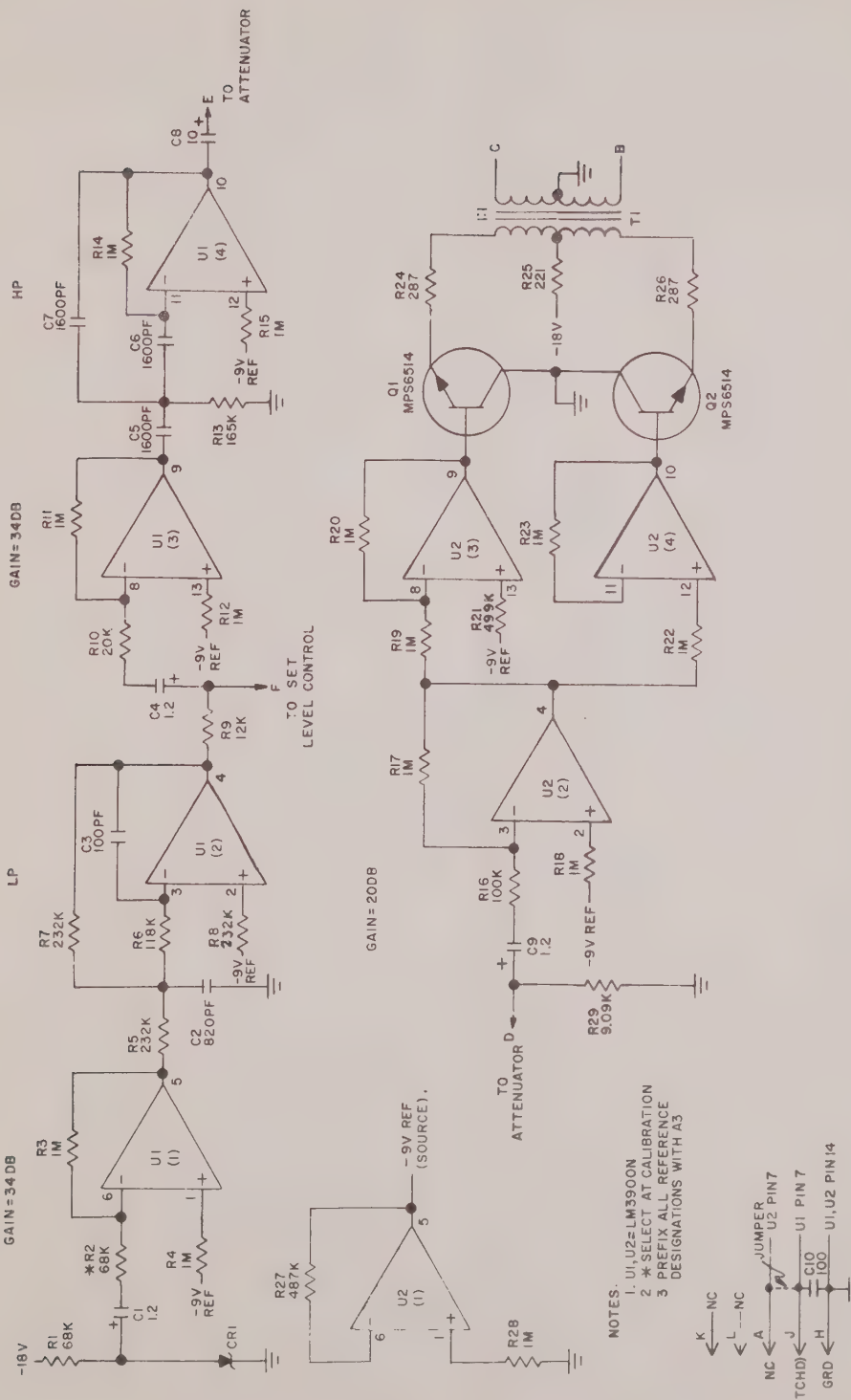


Fig. 6.2 Noise Generator, Schematic Diagram

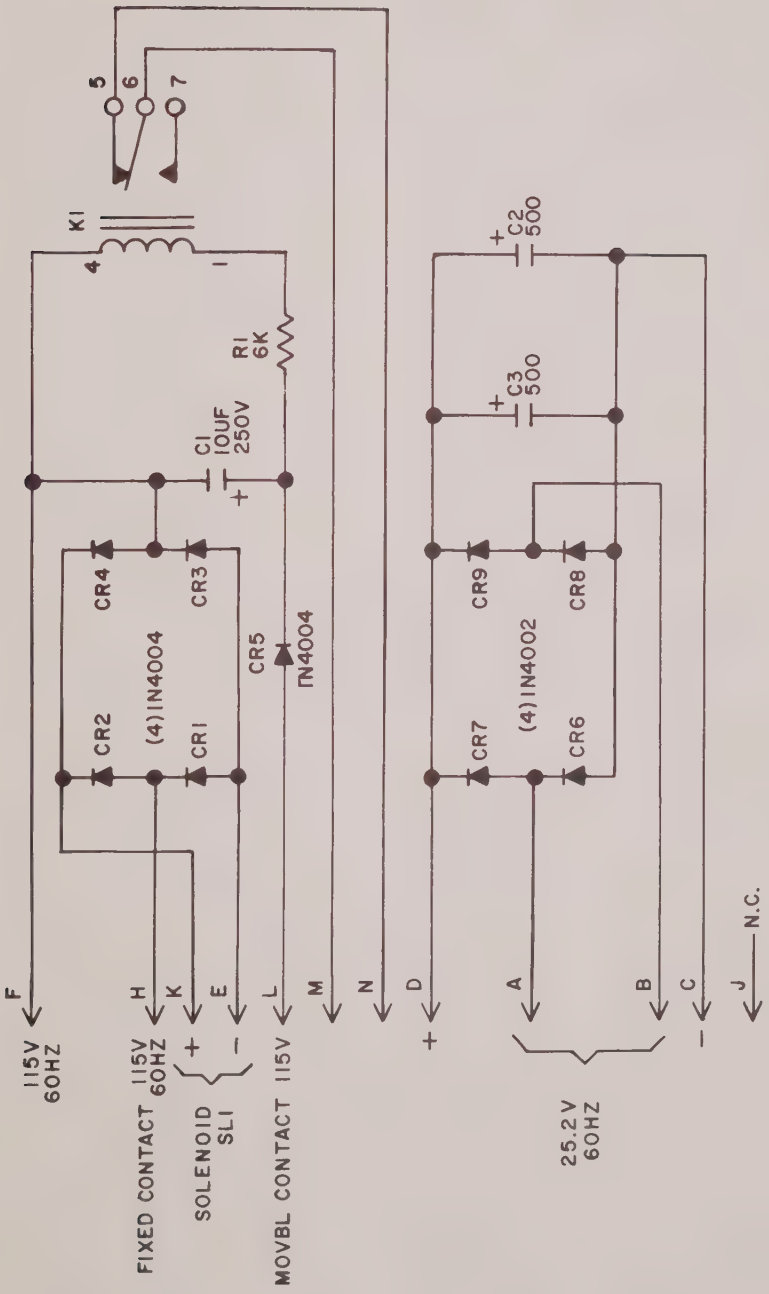


Fig. 6.3 Component Board, Schematic Diagram

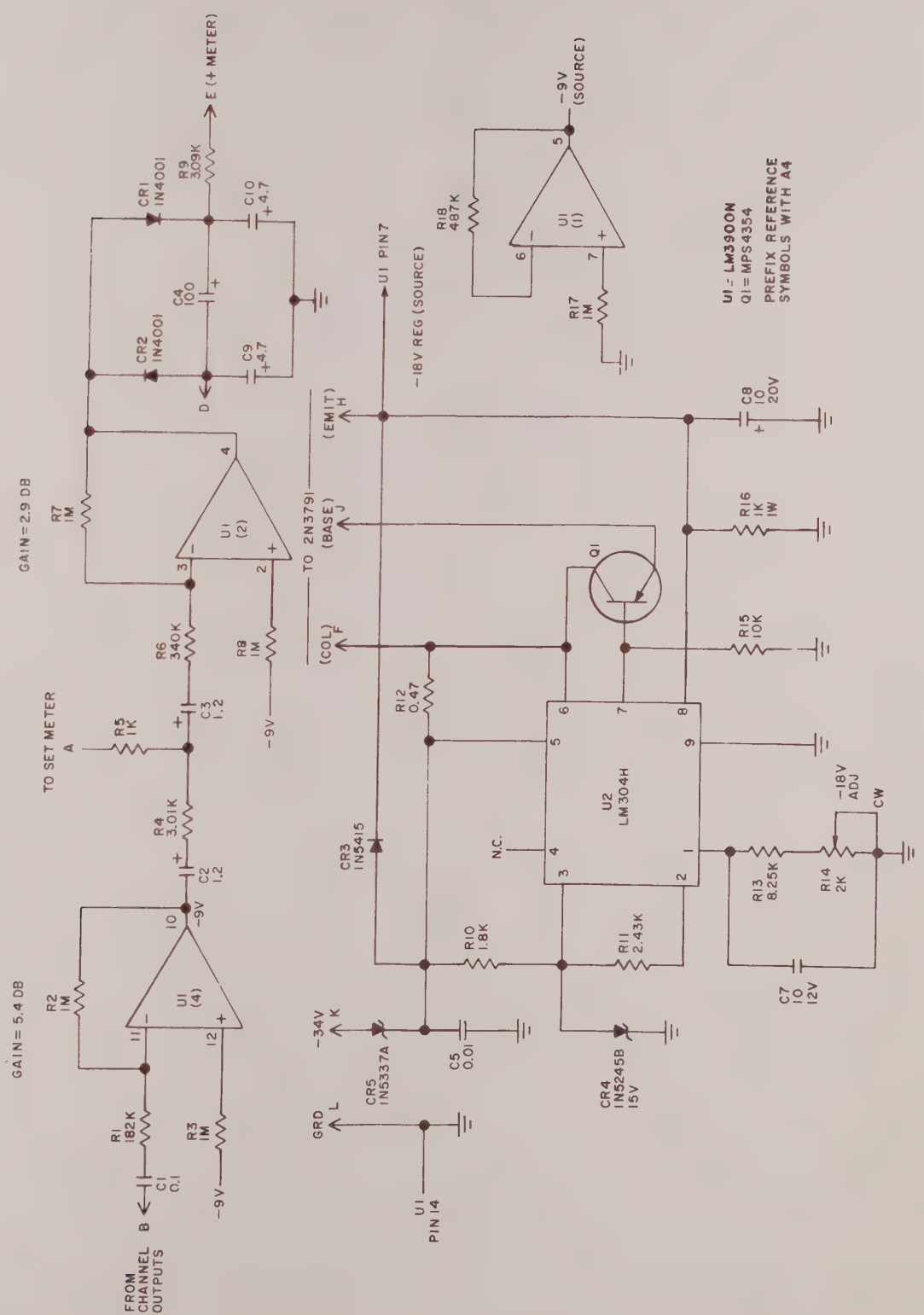


Fig. 6.4 Power Supply and Monitor Board, Schematic Diagram

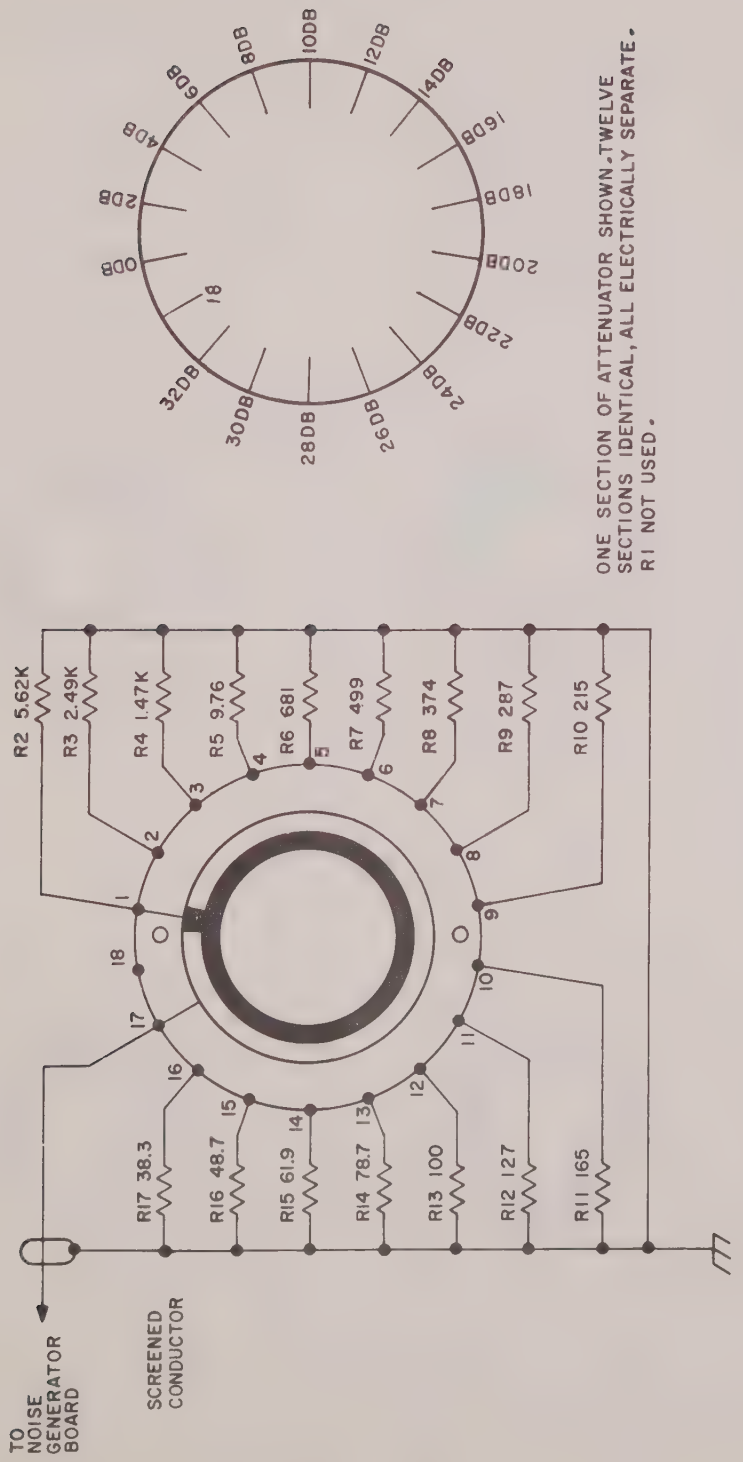


Fig. 6.5 Attenuator Section Circuit Diagram

Fig. 6.6 Detail of Attenuator Drive Switches

Appendix A — Options

CONVERSION FOR REMOTE PROGRAMMING

Provision has been made for the addition of a remote programming facility in the Model TM7816A. The conversion is simple and may, if preferred, be performed by the customer with the aid of a kit of parts and drawings available from Marconi Instruments. Functions brought under remote control by this option are the Attenuator setting and channel ON/OFF selection: a switch on the front panel transfers control of these functions from the manual switches to the remote source.

Depending on the nature of the control commands available, the customer may specify any one of the following program codes to control Attenuator setting:

(a) Positive = true binary coded decimal (5 lines)

(b) Positive = true binary (5 lines)

(c) One = out-of-N (17 lines)

The channel ON/OFF selection is controlled by an "r-out-of-N" program format. All control signals must be DTL/TTL compatible.

Appendix B — Interchangeability

The Model TM7816A twelve-channel noise generator has been designed with two-way interchangeability of plug-in components with similar parts of the Model TM7816 constituting a major consideration. This design feature will serve to facilitate maintenance of the generators.

Although their detail components and schematic arrangements do not coincide, the Noise Generator Boards and the Power Supply and Monitor Board used in TM7816A are electrically and functionally interchangeable with the counterpart boards used in TM7816.

The Attenuator Assembly used in TM7816A differs from the Attenuator Assembly used in TM7816 by the absence of resistor R1 on the TM7816A unit. As all spare Attenuator Assemblies will be of the TM7816 configuration in order to further commonality of parts, use of a spare attenuator in TM7816A will require only the connection of the incoming lead to the junction side of the redundant R1 resistor.

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